Listing of the CLAIMS:

Without prejudice, this listing of the claims replaces all prior versions and listings of the claims in the present application:

LISTING OF CLAIMS:

1. (Previously Presented) A foreground object and background sprite separation and extraction method for extracting a foreground object and a background sprite, comprising the steps of:

obtaining a global motion for transforming a coordinate system between a reference frame and a frame for each of frames in a moving image;

mapping an original image corresponding to said frame into a reference coordinate system for said each of frames by using said global motion, and obtaining a pixel value at a point in said reference coordinate system from pixel values of pixels which exist in the same point;

generating a provisional sprite where foreground objects are deleted;

cutting out a first image from said provisional sprite by using said global motion;

obtaining a difference image between said first image and said original image;

extracting, with the provisional sprite, a foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold, and an other region as a background image;

mapping said background image to said reference coordinate system by using said global motion for said each of frames by inserting a new pixel in a point where a pixel value is not yet decided, or by overwriting a pixel, for generating, with the provisional sprite, and outputting a background sprite without the foreground objects.

2. (Original) The foreground object and background sprite separation and extraction method as claimed in claim 1, further comprising the steps of:

cutting out a second image from said background sprite by using said global motion;

obtaining a difference image between said second image and said original image;

extracting a foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold.

3. (Previously Presented) A foreground object and background sprite separation and extraction apparatus for extracting a foreground object and a background sprite, comprising:

means for obtaining a global motion for transforming a coordinate system between a reference frame and a frame for each of frames in a moving image;

means for mapping an original image corresponding to said frame into a reference coordinate system for said each of frames by using said global motion, and obtaining a pixel value at a point in said reference coordinate system from pixel values of pixels which exist in the same point;

means for generating a provisional sprite where foreground objects are deleted;

means for cutting out a first image from said provisional sprite by using said global motion;

means for obtaining a difference image between said first image and said original image;

means for extracting, with the provisional sprite, a foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold, and extracting an other region as a background image;

means for mapping said background image to said reference coordinate system by using said global motion for said each of frames by inserting a new pixel in a point where a pixel value is not yet decided, or by overwriting a pixel, for generating, with the provisional sprite, and outputting a background sprite without the foreground objects.

4. (Original) The foreground object and background sprite separation and extraction apparatus as claimed in claim 3, further comprising:

means for cutting out a second image from said background sprite by using said global motion;

means for obtaining a difference image between said second image and said original image;

means for extracting a foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold.

5. (Previously Presented) A computer readable medium storing program code for causing a computer to extract a foreground object and a background sprite, comprising:

program code means for obtaining a global motion for transforming a coordinate system between a reference frame and a frame for each of frames in a moving image;

program code means for mapping an original image corresponding to said frame into a reference coordinate system for said each of frames by using said global motion, and obtaining a pixel value at a point in said reference coordinate system from pixel values of pixels which exist in the same point;

program code means for generating a provisional sprite where foreground objects are deleted;

program code means for cutting out a first image from said provisional sprite by using said global motion;

program code means for obtaining a difference image between said first image and said original image;

program code means for extracting, with the provisional sprite, a foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold, and an other region as a background image;

program code means for mapping said background image to said reference coordinate system by using said global motion for said each of frames by inserting a new pixel in a point where a pixel value is not yet decided, or by overwriting a pixel, for generating, with the provisional sprite, and outputting a background sprite without the foreground objects.

6. (Original) The computer readable medium as claimed in claim 5, further comprising:

program code means for cutting out a second image from said background sprite by using said global motion;

program code means for obtaining a difference image between said second image and said original image;

program code means for extracting a foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold.

7. (Original) A segmentation mask extraction method in object coding in moving image coding, comprising the steps of:

receiving a foreground mask image where a foreground part is represented by first value and a background part is represented by a second value;

providing a first value as an alpha value to all shape pixels in each of first macro-blocks when the number of pixels of said foreground part in said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

providing said first value as said alpha value to all shape pixels in each of second macroblocks when the number of pixels of said foreground part in said second macro-block is equal to or larger than a second predetermined value m ($m<n$), wherein said second macro-block is close to said first macro-block where said first value is provided; and

outputting said segmentation mask.

8. (Original) The segmentation mask extraction method as claimed in claim 7, further comprising the steps of:

receiving each of third macro-blocks which has been determined as said background part; and

providing said first value to said third macro-block when a difference image between a background image and an original image which correspond to said third macro-block includes a pixel which has a difference value equal to or larger than a threshold.

9. (Original) A segmentation mask extraction method in object coding in moving image coding, comprising the steps of:

receiving a foreground mask image;

generating a number map by calculating the number of pixels of a foreground part for each of macro-blocks in said foreground mask image;

initializing a foreground map;

providing a predetermined value to each of positions in said foreground map corresponding to first macro-blocks when a value of said number map corresponding to said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

providing said predetermined value to each of positions in said foreground map corresponding to second macro-blocks when a value of said number map corresponding to said second macro-block is equal to or larger than a second predetermined value m (m<n), wherein said second macro-block is close to said first macro-block where said predetermined value is provided; and

generating said segmentation mask from said foreground map and outputting said segmentation mask.

10. (Original) A segmentation mask extraction apparatus in object coding in moving image coding, comprising:

means for receiving a foreground mask image where a foreground part is represented by a first value and a background part is represented by a second value;

first macro-block approximation means for providing a first value as an alpha value to all shape pixels in each of first macro-blocks when the number of pixels of said foreground part in said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

second macro-block approximation means for providing said first value as said alpha value to all shape pixels in each of second macro-blocks when the number of pixels of said foreground part in said second macro-block is equal to or larger than a second predetermined value m (m<n) wherein said second macro-block is close to said first macroblock where said first value is provided in said first macro-block approximation means; and

means for outputting said segmentation mask.

11. (Original) The segmentation mask extraction apparatus as claimed in claim 10, further comprising:

means for receiving each of third macro-blocks which has been determined a said background part; and

means for providing said first value to said third macro-block when a difference image between a background image and an original image which correspond to said third macro-block includes a pixel which has a difference value equal to or larger than a threshold.

12. (Original) A segmentation mask extraction apparatus in object coding in moving image coding, comprising the steps of:

means for receiving a foreground mask image;

means for generating a number map by calculating the number of pixels of a foreground part for each of macro-blocks in said foreground mask image;

means for initializing a foreground map;

means for providing a predetermined value to each of positions in said foreground map corresponding to first macro-blocks when a value of said number map corresponding to said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

means for providing said predetermined value to each of positions in said foreground map corresponding to second macro-block when a value of said number map corresponding to said second macroblock is equal to or larger than a second predetermined value m ($m<n$), wherein said second macro-block is close to said first macro-block where said predetermined value is provided; and

generating said segmentation mask from said foreground map and outputting aid segmentation mask.

13. (Original) A computer readable medium storing program code for causing a computer to extract a segmentation mask in object coding in moving image coding, comprising:

program code means for receiving a foreground mask image where a foreground part is represented by a first value and a background part is represented by a second value;

first macro-block approximation program code means for providing a first value as an alpha value to all shape pixels in each of first macro-blocks when the number of pixels of said foreground part in said first macro-block is equal to or larger than a first predetermined value $n \geq 1$);

second macro-block approximation program code means for providing said first value as said alpha value to all shape pixels in each of second macro-blocks when the number of pix is of said foreground part in said second macro-block is equal to or larger than a second predetermined value m ($m<n$), wherein said second macro-block is close to said first

macro-block where said first value is provided in said first macro-block approximation program code means; and

program code means for outputting said segmentation mask.

14. (Original) The computer readable medium as claimed in claim 13, further comprising:

program code means for receiving each of third macro-blocks which has been determined as said background part; and

program code means for providing said first value to said third macro-block when a difference image between a background image and an original image which correspond to said third macroblock includes a pixel which has a difference value equal to or larger than a threshold.

15. (Original) A computer readable medium storing program code for causing a computer to extract a segmentation mask in object coding in moving image coding, comprising:

program code means for receiving a foreground mask image;

program code means for generating a number map by calculating the number of pixels of a foreground part for each of macro-blocks in said foreground mask image;

program code means for initializing a foreground map;

program code means for providing a predetermined value to each of positions in said foreground map corresponding to first macro-blocks when a value of said number map corresponding to said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

program code means for providing said predetermined value to each of positions in said foreground map corresponding to second macro-blocks when a value of said number map corresponding to said second macro-block is equal to or larger than a second predetermined value m ($m<n$), wherein said second macro-block is close to said first macroblock where said predetermined value is provided; and

program code generating said segmentation mask from said foreground map and outputting said segmentation mask.

16. (Original) A segmentation mask extraction method for extracting a segmentation mask by using a difference image between a background image and an image, comprising the steps of:

obtaining said difference image by calculating an absolute difference between said background image and said image fox each pixel;

initializing an energy map for each macroblock of said difference image;

calculating energy values for said each macro-block;

obtaining an average of said energy values;

calculating a foreground ratio which is a ratio of the size of a foreground mask to the size of said image; and

generating said segmentation mask by using said foreground ratio.

17. (Previously Presented) A segmentation mask extraction method for extracting a segmentation mask by using a difference image between a background image and an image, comprising the steps of:

obtaining said difference image by calculating an absolute difference between said background image and said image fox each pixel;

initializing an energy map for each macroblock of said difference image;

calculating energy values for said each macro-block;

obtaining an average of said energy values;

calculating a foreground ratio which is a ratio of the size of a foreground mask to the size of said image;

generating said segmentation mask by using said foreground ratio;

obtaining a divided value by dividing said energy value by said average for said each macroblock, and providing 0 as an energy value to a macro-block when said divided value is equal to or smaller than α ($\alpha \geq 1.0$);

obtaining a maximum energy value as a first predetermined value, setting a second predetermined value which is smaller than said first predetermined value, and initializing a foreground map;

initializing a temporary foreground map;

providing a predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said first predetermined value;

counting a count number of macro-blocks where said temporary foreground map has said predetermined value;

generating said segmentation mask from said foreground map and outputting said segmentation mask if a value obtained by dividing said count number by the number of all macro- locks is larger than a third predetermined value which is predetermined, if not, copying values of said temporary foreground map to said foreground map;

iterating a providing step until a divided number obtained by dividing said count number by the number of all macro-blocks becomes larger than said third predetermined value, wherein said providing step is a step of providing said predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said second predetermined value, said each macro-block being close to a macro-block which has said predetermined value in said foreground map; and

when said divided number does not become larger than said third predetermined value after iterating said providing step, copying values of said temporary foreground map to said foreground map, updating said first predetermined value and said second predetermined value, and performing said steps after said step of initializing said temporary foreground map.

18. (Original) A segmentation mask extraction apparatus for extracting a segmentation mask by using a difference image between background image and an image, comprising:

means for obtaining said difference image by calculating an absolute difference between said background image and said image for each pixel;

means for initializing an energy map for each macro-block of said difference image;

means for calculating energy values for said each macro-block;

means for obtaining an average of said energy values;

means for calculating a foreground ratio which is a ratio of the size of a foreground mask to the size of said image; and

means for generating said segmentation mask by using said foreground ratio.

19. (Previously Presented) A segmentation mask extraction apparatus for extracting a segmentation mask by using a difference image between background image and an image, comprising:

means for obtaining said difference image by calculating an absolute difference between said background image and said image for each pixel;

means for initializing an energy map for each macro-block of said difference image;

means for calculating energy values for said each macro-block;

means for obtaining an average of said energy values;

means for calculating a foreground ratio which is a ratio of the size of a foreground mask to the size of said image;

means for generating said segmentation mask by using said foreground ratio;

means for obtaining a divided value by dividing said energy value by said average for said each macro-block, and providing 0 as an energy value to a macro-block when said divided value is equal to or smaller than α ($\alpha \geq 1.0$);

means for obtaining a maximum energy value as a first predetermined value, setting a second predetermined value which is smaller than said first predetermined value, and initializing a foreground map;

means for initializing a temporary foreground map;

means for providing a predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said first predetermined value;

means for counting a count number of macro-blocks where said temporary foreground map has said predetermined value;

means for generating said segmentation mask from said foreground map and outputting said segmentation mask if a value obtained by dividing said count number by the number of all macro-blocks is larger than a third predetermined value which is predetermined, if not, copying values of said temporary foreground map to said foreground map;

means for iterating a providing step until a divided number obtained by dividing said count number by the number of all macro-blocks becomes larger than said third predetermined value, wherein said providing step is a step of providing said predetermined

value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said second predetermined value, said each macro-block being close to a macro-block which has said predetermined value in said foreground map; and

means for copying values of said temporary foreground map to said foreground map, updating said first predetermined value and said second predetermined value, and performing said steps after said step of initializing said temporary foreground map, when said divided number does not become larger than said third predetermined value after iterating said providing step.

20. (Original) A computer readable medium storing program code for causing a computer to extract a segmentation mask by using a difference image between a background image and an image, comprising:

program code means for obtaining said difference image by calculating an absolute difference between said background image and said image for each pixel;

program code means for initializing an energy map for each macro-block of said difference image;

program code means for calculating energy values for said each macro-block;

program code means for obtaining an average of said energy values;

program code means for calculating a foreground ratio which is a ratio of the size of a foreground mask to the size of said image; and

program code means for generating said segmentation mask by using said foreground ratio.

21. (Previously Presented) A computer readable medium storing program code for causing a computer to extract a segmentation mask by using a difference image between a background image and an image, comprising:

program code means for obtaining said difference image by calculating an absolute difference between said background image and said image for each pixel;

program code means for initializing an energy map for each macro-block of said difference image;

program code means for calculating energy values for said each macro-block;

program code means for obtaining an average of said energy values;

program code means for calculating a foreground ratio which is a ratio of the size of a foreground mask to the size of said image;

program code means for generating said segmentation mask by using said foreground ratio;

program code means for obtaining a divided value by dividing said energy value, by said average for said each macro-block, and providing 0 as an energy value to a macro-block when said divided value is equal to or smaller than α ($\alpha \geq 1.0$);

program code means for obtaining a maximum energy value as a first predetermined value, setting a second predetermined value which is smaller than said first predetermined value, an initializing a foreground map;

program code means for initializing a temporary foreground map;

program code means for providing a predetermined value to each macro-block position in said temporary foreground map whey said energy value is equal to or larger than said first predetermined value;

program code means for counting a count number of macro-blocks where said temporary foreground map has said predetermined value;

program code means for generating said segmentation mask from said foreground map and outputting said segmentation mask if a value obtained by dividing said count number by the number of all macro-blocks is larger than a third predetermined value which is predetermined, if not, copying values of said temporary foreground map to said foreground map;

program code means for iterating a providing step until a divided number obtained by dividing said count number by the umber of all macro-blocks becomes larger than said third predetermined value, wherein said providing step is a step of providing said predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said second predetermined value, said each macro-block being close to a macro block which has said predetermined value in said foreground map; and

program code means for copying values of said temporary foreground map to said foreground map, updating said first predetermined value and said second predetermined value, and performing said steps after said step of initializing said temporary foreground map,

when said divided umber does not become larger than said third predetermined value after iterating said providing step.

22. (Original) A segmentation mask extraction method for extracting a segmentation mask by using a difference image between a background image and an image, comprising:

a first step of regarding each of first macro-blocks as the foreground when an energy value of said first macro-block which is obtained by said difference image is equal to or larger than a first predetermined value;

a second step of regarding each of second macro-blocks as the foreground when an energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to a macro-block which is determined as the foreground in said first step.

23. (Original) The segmentation mask extraction method as claimed in claim 22, further comprising a step of iterating said second step for predetermined times.

24. (Original) A segmentation mask extraction method for extracting a segmentation mask by using a difference image between a background image and an image, comprising the steps of:

calculating energy value of each macro-block from said difference image and calculating an average of said energy values;

obtaining a divided value by dividing said energy value by said average for said each macro-block, and providing 0 as an energy value to a macro-block when said divided value is equal to or smaller than a predetermined value;

regarding each of first macro-blocks as the foreground when said energy value of said first macro-block is equal to or larger than a first predetermined value;

iterating, predetermined times, a step of regarding each of second macro-blocks as the foreground when said energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to said first macro-block which is determined as the foreground.

25. (Original) A segmentation mask extraction apparatus for extracting a segmentation mask by using a difference image between a background image and an image, comprising:

first means for regarding each of first macro-blocks as the foreground when an energy value of said first macro-block which is obtained by said difference image is equal to or larger than a first predetermined value;

second means for regarding each of second macro-blocks as the foreground when an energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to a macro-block which is determined as the foreground in said first means.

26. (Original) The segmentation mask extraction apparatus as claimed in claim 25, further comprising means for iterating the process by said second means for predetermined times.

27. (Original) A segmentation mask extraction apparatus for extracting a segmentation mask by using a difference image between a background image and an image, comprising:

means for calculating energy values of each macro-block from said difference image and calculating an average of said energy values;

means for obtaining a divided value by dividing said energy value by said average for said each macro-block, and providing 0 as said energy value to a macro-block when said divided value is equal to or smaller than a predetermined value; means for regarding each of first macro-blocks as the foreground when said energy value of said first macro-block is equal to or larger than a first predetermined value;

means for iterating, predetermined times, a step of regarding each of second macro-blocks as the foreground when said energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to said first macro-block which is determined as the foreground.

28. (Original) A computer readable medium storing program code for causing a computer to extract a segmentation mask by using a difference image between a background image and an image, comprising:

first program code means for regarding each of first macro-blocks as the foreground when an energy value of said first macro-block which is obtained by said difference image is equal to or larger than a first predetermined value;

second program code mean for regarding each of second macro-blocks as the foreground when an energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to macro-block which is determined as the foreground in said first program code means.

29. (Original) The computer readable medium as claimed in claim 28, further comprising program code means for iterating the process by said second program code means for predetermined times.

30. (Original) A computer readable medium storing program code for causing a computer to extract a segmentation mask by using a difference image between a background image and an image, comprising:

program code means for calculating energy values of each macro-block from said difference image and calculating an average of said energy values;

program code means for obtaining a divided value by dividing said energy value by said average for said each macro-block, and providing 0 as said energy value to a macro-block when said divided value is equal to or smaller than predetermined value;

program code means for regarding each of first macro-blocks as the foreground when said energy value of said first macro-block is equal to or larger than a first predetermined value;

program code means for iterating, predetermined times, a step of regarding each of second macro-blocks as the foreground when said energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to said first macro-block which is determined as the foreground.

31. (Previously Presented) The method of claim 1, wherein the foreground object image is automatically extractable without a chroma key, manual processing is not required, and outline information of the foreground object is obtainable.

32. (Previously Presented) The method of claim 31, wherein the background sprite is a good-quality or clear background sprite.

33. (Previously Presented) The method of claim 1, wherein the background sprite is a good-quality or clear background sprite.

34. (Previously Presented) The apparatus of claim 3, wherein the foreground object image is automatically extractable without a chroma key, manual processing is not required, and outline information of the foreground object is obtainable.

35. (Previously Presented) The apparatus of claim 34, wherein the background sprite is a good-quality or clear background sprite.

36. (Previously Presented) The apparatus of claim 3, wherein the background sprite is a good-quality or clear background sprite.

37. (Previously Presented) The computer readable medium of claim 5, wherein the foreground object image is automatically extractable without a chroma key, manual processing is not required, and outline information of the foreground object is obtainable.

38. (Previously Presented) The computer readable medium of claim 37, wherein the background sprite is a good-quality or clear background sprite.

39. (Previously Presented) The computer readable medium of claim 5, wherein the background sprite is a good-quality or clear background sprite.

40. (Previously Presented) The method of claim 7, wherein the two-stage macro-block approximation for extracting a segmentation mask provides that there is no hole in an extracted object.

41. (Previously Presented) The method of claim 40, wherein the two-stage macro-block based shape approximation reduces macro-block shape information and erosion of the foreground part.

42. (Previously Presented) The method of claim 9, wherein the two-stage macro-block approximation for extracting a segmentation mask provides that there is no hole in an extracted object.

43. (Previously Presented) The method of claim 42, wherein the two-stage macro-block based shape approximation reduces macro-block shape information and erosion of the foreground part.

44. (Previously Presented) The method of claim 7, wherein two-stage the macro-block based shape approximation reduces macro-block shape information and erosion of the foreground part.

45. (Previously Presented) The method of claim 9, wherein the two-stage macro-block based shape approximation reduces macro-block shape information and erosion of the foreground part.